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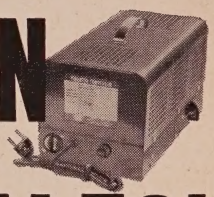

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ULTRA-HIGH-RESISTANCE CENTER-ZERO D. C. VOLTMETER

The use of high-resistance d. c. voltmeters in electronic circuit testing is not a fad but a necessity. Because voltages must be measured across high resistances in such circuits as a. v. c. networks, control grid to ground, television input circuits, resistance-coupled plates, power detector cathode to ground, photocell loads, and similar positions without interfering with operation of the circuit, the trend during recent years has been completely away from meters of the 1,000 ohms-per-volt type which load the test circuit so heavily that accuracy is impaired. Present preferred non-electronic meters are of the 20,000 ohms-per-volt type, and electronic meters have input resistances of 11 to 16 megohms.

The electronic d. c. voltmeter ordinarily is favored over the non-electronic type. Its popularity is due chiefly to its high input resistance. In a number of instances, however, use of the electronic meter is not feasible. One such instance is field testing remote from power lines or when a battery-type v. t. voltmeter is not available. The instrument described in this article has been designed as a compromise between the currently popular 20,000 ohms-per-volt non-electronic instrument and the d. c. vacuum tube voltmeter. It provides an input resistance of 100,000 ohms per volt. A center-zero indicating meter is employed, so that polarity of the test voltage is indicated automat-

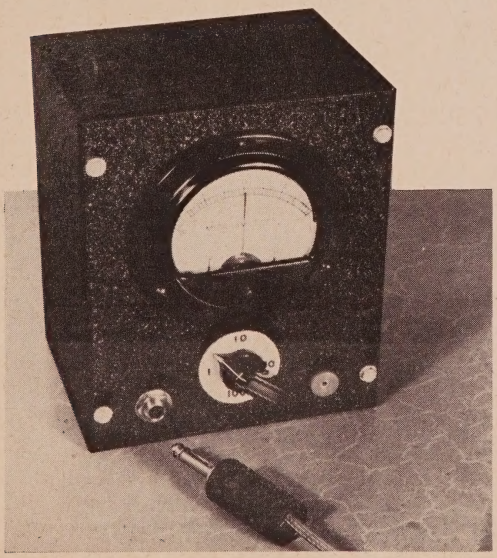

Fig. 1. The completed Ultra-High-Resistance D. C. Voltmeter. The scale of the 10-0-10 microammeter is read directly as 0-1, 10, 100, or 1000 volts. The "high" input jack is in the lower left-hand corner and the plug of the high test cable is laying in front of it. The low input tip jack is in the lower right-hand corner.

LIST OF PARTS

C—0.002 ufd. mica capacitor

J_1—Miniature open-circuit phone jack

J_2—Phone-tip jack

M—10-0-10 d. c. microammeter

R_1—50,000-ohm ½ watt carbon resistor

R_2—47,000-ohm ½ watt carbon resistor

R_3—1000-ohm ½ watt carbon resistor

R_4—0.91-megohm ½ watt carbon resistor

R_5—36,000-ohm ½ watt carbon resistor

R_6—2000-ohm ½ watt carbon resistor

R_7—8.2 megohm ½ watt carbon resistor

R_8—1.5 megohm ½ watt carbon resistor

R_9—240,000 ohm ½ watt carbon resistor

R_{10}—8,000 ohm ½ watt carbon resistor

R_{11} to R_{19}—11-megohm ½ watt carbon resistor

R_{20}—0.91-megohm ½ watt carbon resistor

R_{21}—20,000-ohm ½ watt carbon resistor

R_{22}—20,000-ohm ½ watt carbon resistor

S—Single-pole, 4-position, non-shorting, rotary selector switch.

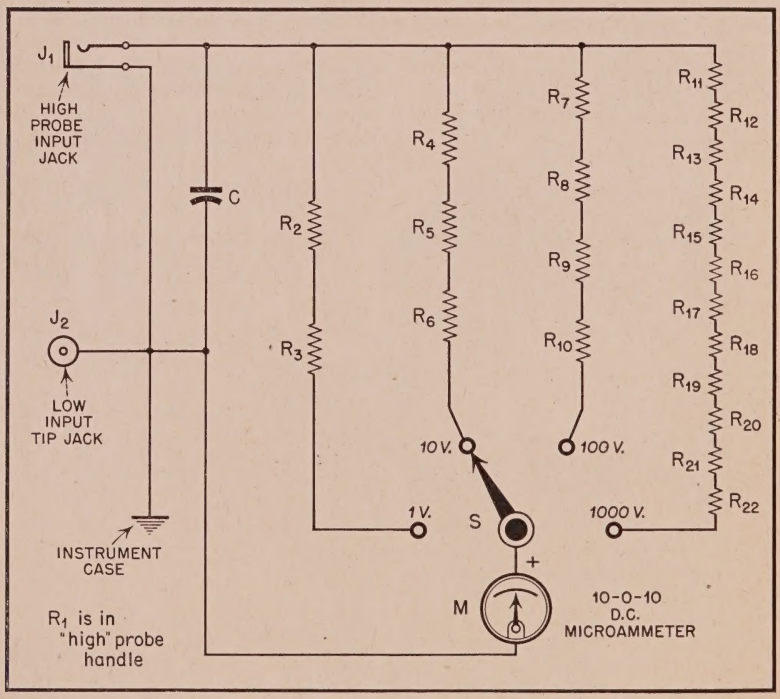

Fig. 2 Circuit of the Ultra-High-Resistance Voltmeter

ically, and polarity switching or swapping of the test leads is unnecessary.

Voltage Ranges

This voltmeter covers 0.05 to 1,000 volts in four ranges; 0-1, 0-10, 0-100, and 0-1000 volts. The smallest accurately-read deflection (1 scale division) on the 0-1-volt range is 0.05 volt, or 50 millivolts. One-half division, corresponding to 0.025 volt or 25 millivolts, is readable. The indicating meter is a 10-0-10 d. c. microammeter.

The sensitivity of the instrument is constant at 100,000 ohms per volt on all ranges. The total resistance presented to the circuit under test is 100,000 ohms on the 1-volt range, 1 megohm on the 10-volt, 10 megohms on the 100-volt, and 100 megohms on the 1000-volt range.

Input Circuit and Meter Response

A 50,000-ohm isolating resistor is wired into the "high" test probe used with this instrument. This resistor, together with the electrostatic shielding of the probe handle and cable, serves to minimize capacitance effects introduced by the operator's fingers. This is a feature usually found only in d. c. vacuum tube voltmeters. The 50,000-ohm probe resistance is subtracted from each of the meter multiplier resistor values.

The zero position of the microammeter is at center scale. Deflection is upscale when the high probe is in contact with the positive terminal of the circuit under test, and is downscale when the high probe is negative. The scale is linear in both directions. The regular 0-10 microampere scale is directly as 0-10 volts. 0-1, 0-100, and 0-1000 volts are read simply by adding or subtracting end ciphers mentally to or from the basic 0-10 scale.

Because of the unusually high input resistance and consequent low current drain of the voltmeter, circuit loading and detuning effects are negligible. This instrument accordingly will find use in applications formerly served only by d. c. vacuum tube instruments. It will be particularly useful in measuring voltages in circuits in which both instrument terminals must be above ground.

Complete Circuit

The complete circuit diagram of the new voltmeter is shown in Figure 2.

The shielded handle of the high test probe contains the 50,000-ohm isolating resistor, R_3, which is mounted close to the probe tip. A detail sketch showing construction of this probe is given in Figure 4. A single-conductor, flexible, shielded cable is run between the probe and a standard phone plug. The outer conductor (shield braid) of this cable is connected to the ground sleeve of the plug, while its center conductor is connected to the plug tip-ball.

When the instrument is in use, the plug is inserted into jack J_1 which is bypassed by capacitor C to remove any a. c. component which may be present in the d. c. voltage being measured. The tip jack, J_2, is connected by means of a flexible test lead (which may be terminated either with a standard test prod or an alligator clip) which is run to the "low" side of the circuit (usually ground or B-minus) under test.

The meter, M, is a 3½-inch Marion Model 53RN 10-0-10 d. c. microammeter. This meter has an internal resistance of approximately 2000 ohms and requires 20 millivolts for full-scale deflection in either direction from center zero. The 2000-ohm meter resistance value is subtracted from each of the multiplier resistance

CHART I.

Voltage Range (volts)	Required Multiplier (ohms)	Preferred Stock Resistors Used (series connected)
0-2.5	198,000	0.18 meg. + 18,000 ohms
0-5	494,800	0.47 meg. + 22,000 + 2700 + 100
0-25	2,494,800	2.4 meg. + 91,000 + 2700 + 1100
0-50	4,948,000	4.7 meg. + 0.22 meg. + 27,000 + 1000
0-250	24,948,000	12 meg. + 12 meg. + 0.91 meg. + 27,000 + 10,000 + 1000
0-500	49,948,000	22 meg. + 22 meg. + 0.91 meg. + 4.7 meg. + 0.15 meg. + 0.15 meg. + 27,000 + 10,000 + 1000

values normally calculated, except in the case of the 1000-volt multiplier, since no appreciable increase in accuracy is obtained on this range by making the subtraction.

The multiplier resistors are made up of carefully selected ½-watt carbon resistors. Each multiplier consists of several resistors connected in series to obtain the required resistance total. Thus, the 1-volt-range resistor (which normally would be calculated as 100,000 ohms) consists of R_2 and R_3 in series. This combination gives 48,000 ohms which is the calculated value of 100,000 ohms minus 50,000 ohms probe resistance (R_1) minus 2000 ohms meter resistance. Similarly, the 10-volt multiplier consists of R_4, R_5, and R_6 in series; and the 100-volt multiplier is made up of R_7, R_8, R_9, and R_{10}. The 1000-volt multiplier contains 12 series-connected resistors. This relatively long resistor string affords best accuracy and, at the same time, provides a long surface leakage path to prevent high voltage error.

The 1-, 10-, 100-, and 1000-volt ranges were judged the most generally useful for radio and electronic testing. If the builder is interested in intermediate voltage ranges, he may select the required multiplier resistance values from Chart I.

The range switch, S, is a single-pole, 4-position, non-shorting rotary selector switch, preferably one with ceramic insulation.

Construction

The instrument, as it appears in Figure 1, is built into a standard metal radio utility box, 6″ high, 5″ wide, and 4″ deep. A wooden or plastic case may be used instead, if the reader prefers.

The meter hole, in the center vertical line of the front panel, is 2-¾ inch in diameter. Holes for the probe jack (see lower left-hand corner of the front panel) and the range switch (directly under the meter) are ⅜ inch in diameter. The tip-jack hole (lower right-hand corner of the front panel) is $\frac{5}{16}$ inch in diameter.

The multiplier resistors are mounted on two small bakelite strips held to one inner wall of the box and separated from the latter by means of metal or ceramic studs. Resistors R_{11} to R_{22} inclusive, comprising the 1000-volt multiplier, are mounted on a sep-

arate 3¼" x 1½" strip of $\frac{1}{16}$"-thick bakelite (See Figure 3). The pigtail leads of these resistors pass through small holes in this panel and are bent down and soldered together on the

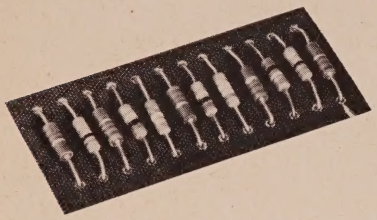

Fig. 3. The 1000-Volt Multiplier Resistor. The 12 tiny resistors mounted on a bakelite strip and wired in series make the high-resistance 1000-v. multiplier. These resistors form the string R_{11} to R_{22} inclusive in Figure 2.

rear side of the panel to make a series connection. This is a simple manner of mounting the resistors firmly without terminals of any kind.

The multiplier resistors must be selected carefully to have the exact values given in Figure 2. The accuracy of the instrument depends largely upon the closeness of these resistors to rated values. A high-grade recently calibrated ohmmeter or resistance bridge should be used in selecting the resistors from stock. If the resistors are taken without any form of measurement, the accuracy of the voltmeter (considering resistor and microammeter tolerances) will not be better than about 13 percent of full-scale.

While the instrument undoubtedly could have been mounted in a case with less depth, the author preferred ample "breathing space" inside the case to guard against crowding of components and possible flashover.

Use insulated, solid hookup wire for all connections inside the instrument. Keep all leads as short and direct as possible. Do not permit

(*Continued on page* 10)

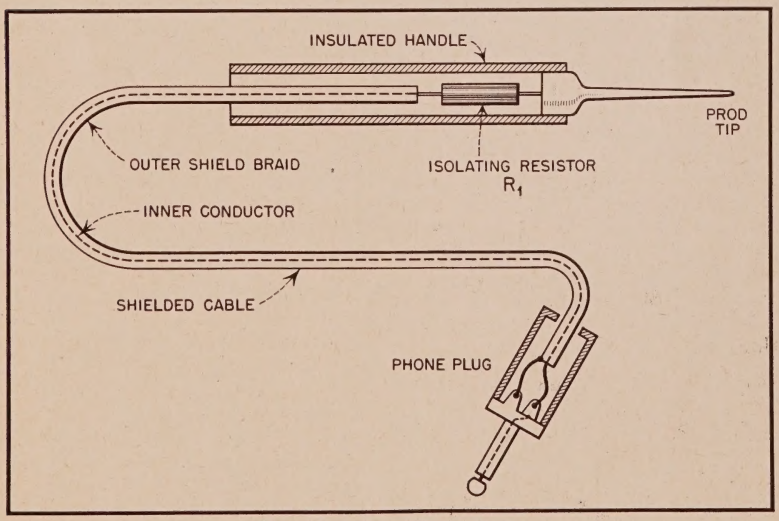

Fig. 4 Detail of "High" Probe

For the MOST in Television Reception

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For Clear Sharp Pictures and Perfect Trouble-Free Performance

Streamlined Weather-proof Housing — Keeps Out Water, Snow and Ice
Heavy-Duty Motor — Reverses Instantly
Heavy-Duty Precision Gears
12 Heavy-Duty Ball Bearings in two 6½" diameter Ball Bearing Races
Will Handle 7/8" to 2" dia. Upper and Lower Masts

IT'S POWER PACKED

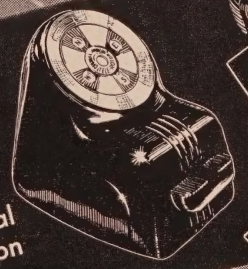
A Triumph in Design!!! There's Nothing Like It... It's Beyond Compare!

CHECK THESE FEATURES

- Handles Heavier Loads With Ease . . . As Much As 150 Pounds
- Streamlined Weather-proof Design . . . Durable Sturdy Construction
- 12 Heavy-Duty Ball Bearings in two 6½" diameter Ball Bearing Races
- Heavily Reinforced Die-Cast Housing
- Heavy-Duty Precision Gears
- Positive Stop at End of Rotation
- Will Handle 7/8" to 2" diameter Upper and Lower Masts
- Heavy-Duty Motor — Reverses Instantly
- Mast, Tower or Platform Mounting
- Four Heavy-Duty Guy-Wire Lugs
- Completely Weather-Sealed . . . Factory Lubricated For Life

C-D SKY HAWK TELE-ROTOR CONTROL

with the "Perfect Pattern" Dial . . . Gives Immediate Indication of Antenna Position.



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loose, flopping leads. On the other hand, do not stretch them tautly.

Make all joints mechanically tight before soldering. Use a good grade rosin-core solder **without any other form of flux or paste.** Use as much as possible of each resistor pigtail, in order to keep the heat of the soldering iron as far as practicable from the body of the resistor.

The shielded flexible cable for the high test probe may be a convenient length of microphone cable or of RG-58 or RG-29 coaxial line. The latter both are small-diameter cables, however, RG-58 is the more flexible of the two. The shield braid of the cable is carried all the way into the inside of the probe handle close to the point of connection of the inner conductor to the 50,000-ohm isolating resistor (See Figure 4).

The range indicator dial plate (See Figure 1) was made from stiff, white Bristol board and was lettered in black India ink and covered with a matching disc of transparent, colorless plastic to prevent soiling.

If the resistors are selected with care, no calibration of the instrument will be required. It will be ready for use as soon as the construction is completed and all wiring has been checked painstakingly.

Operation of the Instrument

All of the rules of practice regarding use of meters apply to this instrument. These rules are important enough for the Editors to risk repetition in listing them here.

1. When in doubt as to the probable value of the voltage to be measured (and we usually are when we check voltages), start with the highest meter range and switch successively to each lower range until an accurately-read deflection is obtained.

2. Always make the final voltage reading on the instrument range which will give a deflection toward the maximum end of the meter scale. This will insure best accuracy.

3. Hold each test probe by its insulating handle, with the fingers removed as far as possible from the metal prod tips. Do not grip the cords or cables, even though they are insulated.

4. Do not hold the instrument in the hands nor rest it on the lap while making measurements. Place it on the table or workbench and keep it out of contact with the body.

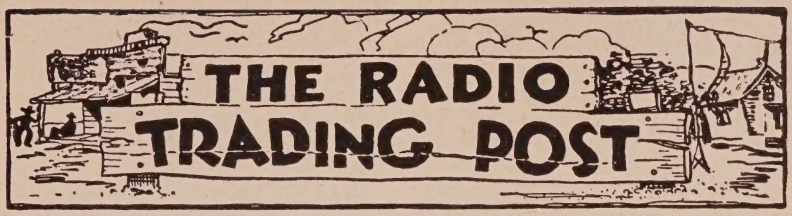
5. When checking circuits in which both meter leads are above ground potential, remember that the normally "low" terminal of the instrument may be nearly as dangerous to the operator as the high terminal.

6. Guard against repeatedly "pinning" the meter, since this is apt to impair the accuracy of the instrument even when the pointer does not become bent.

7. Do not attempt to make measurements with any except the regular "high" test probe designed for use with this instrument. The 50,000-ohm isolating resistor in the handle of this probe is a part of each multiplier resistor inside the instrument and, for best accuracy, must be present in the circuit.

8. When the meter is not in use, keep the range switch set to the 1000-volt position, and remove the test leads from their front-panel plugs.

9. Protect the instrument from all forms of mechanical abuse, such as dropping, striking, and shaking.



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These advertisements are listed FREE of charge to C-D readers so if there is anything you would like to buy or sell, if you wish to obtain a position or if you have a position to offer to C-D readers, just send in your ad.

These columns are open only to those who have a legitimate WANTED, SELL, or SWAP proposition to offer. The Cornell-Dubilier Electric Corp. reserves the right to edit advertisements submitted, and to refuse to run any which may be considered unsuitable. We shall endeavor to restrict the ads to legitimate offers but cannot assume any responsibility for the transaction involved.

Please limit your ad to a maximum of 40 words, including name and address. Advertisements will be run as promptly as space limitations permit.

All ads are published in the order received, but those held over two issues are discarded. Every effort will be made to include your ad either in the issue being prepared or the succeeding number, but will be automatically dropped thereafter.

FOR SALE—33⅓ 78 rpm Rekokut model T-12 transcription turntable, complete with Gray Research adjustable needle pressure arm, less pickup cartridge. Perfect condition. Will ship collect for first $79.95. George Beggs, Warrington, Pa.

FOR SALE—Current model 11 tube FM-AM Lafayette phono chassis, list $77.50. 10" speaker, automatic player. Also 7" Hallicrafter T54. Make offer. Trade S53 or NC57. R. E. Franklin, 239 E. 4th Ave., Roselle, N. J.

TRADE—Electronic test equip., transformers, tubes, transmitters, speakers, receivers, misc. radio parts, all excellent. I want 12, 16, or 20 gauge automatic, pump or double barrel shotguns, new or used. W. G. Worth, 1508 S. Hickory, Bartlesville, Okla.

FOR SALE—A.P.S. 13, 420 megacycle rec. and trans., one or two units at $12.50 per unit. Excellent condition, complete with original tubes. H. W. McKinley, 155 Cedar Hill Ave., Belleville 9, N. J.

FOR SALE—Huge 20x26 TV Picture 520 sq. in. TV Assembly Co., projection model P-520. 100 per cent wired and tested, complete and in perfect condition, list $1495. Make cash offer. Forcier, Essex St., Middleton, Mass.

SELL OR SWAP— Small beam rotator motor, works with 12 MF cond., $3.50; audio filter used with head phones, FL-30 UTC, $1.40; 500w. final kit, $34.50. I want outboard motor, scope. M. E. Lawson, 4010 River Dr., Houston 17, Tex.

FOR SALE—Riders manuals 4 through 13 and abridged 1 to 4. All in perfect condition, $100. Modern Radio Service, 532 Brady St., Davenport, Iowa

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FOR SALE—Marine radio receiver model RCH. Freq. range 80 to 560 kc and 1.9 to 24 mcs., supply 115 v., 60 cycles. M. Elias, 41-42 66th St., Woodside, N. Y.

FOR SALE—Meissner model 8 C FM tuner, A.C. 115 v., $35; Crosley 5 tube push-button auto radio model A 358, $25. Both in good condition. Herbert A. Wills, Greenville, Ohio

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SWAP—Dietzgen log log vector electrical engineers slide rule with leather case, never used. Want Sky Buddy type receiver. Write Jerome Hemmye, 1813 New York Ave., Lansing, Mich.

WANTED—SX28 or SX28A receiver. Will sell or swap 36 watt Eastern amplifier, list $160, excellent, for $60. Floyd Paul, 1240½ N. Central, Glendale 2, Calif.

TRADE—Triplett all purpose tester, model 1175-B, consists of sig. gen. and VOM. Want 38 Smith & Wesson special or Colt .45 auto. pistol. Clinton Weddle, Box 265, Bassett, Va.

SWAP—BC 645 with dynamotor, control box, 2 antenna, converted to phone, may be used mobile; new PE 157 (less speaker); Gibson Girl transmitter unit. All in working condition. Want a tape or wire recorder. Morton Romanoff, 212 W. Kingsbridge Rd., Bronx 63, N. Y.

TRADE—New bicycle radio, good used radios, and radio-phonographs. Want 35 mm camera, exposure meter, pocket VOM, or? E. L. Holley, Box 336, Vaughn, New Mexico

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FOR SALE—Riders manuals 1-7, $9.95 ea.; Aircraft receivers, $10; transmitters 2 to 7mc, $15; Webster changer, 56-1, $19; trans. TV set, 7" all channel, $95; BC 1068 rec., $20. Want SCR 522, kw transformer, BC348, BC788, 50 w PA system. Alfred Livingstone, 12-01 Ellis Ave., Fair Lawn, N. J.

SWAP OR SELL—All sorts ham equip., 300 receiving/trans. tubes. Want VHF152 scope or ham rec. S44 panoramic. D. T. Jones, 316 Kosciuszko St., Nanticoke, Pa.

FOR SALE—Riders 1-17 complete, excellent condition, $125. Vallejo Radio Service, 58 Rodgers, Vallejo, Calif.

WANTED—A three gang variable tuning condenser (not midget) with 365 MMF per section. Prefer standard make. Give price. C. P. Young, 936 Joliet St., New Orleans 18, La.

FOR SALE—Sylvania tube tester 139; Speco sig. tracer amplifier, electronic vacuum tube volt-ohm-meter 100; Jackson volt-ohm-mil-ammeter 642; Hickok tube tester. All perfect. Joseph Truce, Aurora, Ohio

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FOR SALE—IRE Proceedings, '45 to '49, $30; QST, '42 to '49, $12; Radio Digest, No. 2 Sept. '37, to No. 14, '39, $2. All F.O.B. Boonton, N. J. H. A. Bremer, 43 Washington Ave., Lake Hiawatha, N. J.

TRADE—Gent's 1½ carat sapphire gold ring, 1½ carat zircon gold ring, 12" PM speaker, 1 tube phono-amplifier. Want early phono-records of George M. Cohan, Bing Crosby, etc. Fred Simonian, 931 Washington St., Lynn, Mass.

FOR SALE—1/5 hp Jack & Heintz capacitor motor in original carton, 110 v. A.C. Reg. $23.50. Asking $10. Chester Martowicz, 116 E. 7 St., New York 3, N. Y.

WANTED—Tech. manual TM-11-487, Electrical Communication Systems Equipment. Will buy AN/ART-13 xmtr; APN-9 Loran, AN/ARR-11 receiver, BC-221 freq. meter. BC-610 Marine transceiver. Wm. Hansen, 165 Silverbrook, Niles, Mich.

WANT—Neon radio service sign, test gear, Riders manuals, relay racks, plate xfmrs., Eimac tubes, etc. Trade typewriters, guns, etc. Eddie Howell, Rural Station, Box 245, Dillon, S. C.

FOR SALE—Keystone A-82 movie projector with lens 2 inch F 1.6, large screen, 12 400 ft. reels, splicer, etc. Fine condition, $100 FOB or best TV set offered. H. W. Leeds, 15 W. 15 St., Ocean City, N. J.

FOR SALE—TV tubes: 12LP4, $20; 10BP4, $14.75; 1B3/8016, $1.20; Selinum rectifiers: 250MA, 80c, 560MA, $2, 75 MA, 50c Automatic record changer, $8.75; 16" flyback transformer, $6.50; sig. generator, A 200 Electronics approved, $27. Paul Blum, 366 Hunterdon St., Newark 2, N. J.

WANTED—Will buy used radios and appliances in working order. Top prices. Write. Snyder's Radio Service, Pitman Branch c/o Emerald Snyder, Sr., R.F.D. 1, Box 110, Pitman, Pa.

SALE OR TRADE—Philco 050 tube tester, $30; 18 tube experimental TV receiver, channels 2-4-5. Perfect condition, needs 7EP4 tube. Parts alone worth $120. First $60 takes it or what have you. A. J. Kersis, Radio- TV Service Lab, 75 Broadway, Elizabeth 1, N. J.

FOR SALE—Collins 32RA, 150 w. band switching, phone CW transmitter. Very good condition, New York area only, $125 cash. Robert Reiss, 138 Hutchinson Blvd., Mt. Vernon, N. Y.

FOR SALE—Utah 650 changer, BC222 transceiver, give offer. Want Aerovox 95 LC checker, 4, 5 of Riders manuals. Saxton's Radio & Electric Service, Route 1, Pontiac, Ill.

FOR SALE—Heathkits assembled; signal generator, $15; VTVM, $17.50; oscilloscope, $30; unassembled kit, condenser checker, $15; Speco signal tracer, $25. All FOB, Buffalo. Joseph Lag, 51 Johnson St., Buffalo 12, N. Y.

POSITION WANTED—Holder of first class radio telephone operators license desires position anywhere in U. S. Recent graduate of radio communication school, initial salary secondary. J. L. Yurek, 3 Egan Court, Bayonne, N. J.

TRADE—12 ft. speedboat, acetylene welding outfit, Eversharp 14 KT set, Kodak "Bantam", Precision 85 V.O.M., electronic code oscillator, Vibraplex "original", 22 cal. rifle. Want 75-A1 from N. J., Pa., or Del. Dave Graham, 183 Bank St., Bridgeton, N. J.

FOR SALE—RCA model PR1 phonograph any plastic case. Plays through any amplifier or radio. 105v.-125v., 60 cycles, 10 w. Crystal pickup, plays 10", 12". J. Rosenberg, 1932 Daly Ave., New York 60, N. Y.

WANTED—Will buy transmitting, special-purpose and receiving type tubes. B. N. Gensler, 162 Greenwich St., New York 6, N. Y.

SALE OR TRADE—Record changer, electric train, electric razor, F.M. tuner. All in excellent condition. B. T. Hodgen, R.F.D. 5, Frankfort, Ind.

WANTED—Conversion data or schematic wanted for Navy transmitter GF 11/RU-16. Also want HQ129X in perfect condition. C. Gabler, 1307 Merriam Ave., New York 52, N. Y.

SELL OR SWAP—SCR 522 complete, now on air; heavy duty rotator and indicator; M. duty rotator and indicator, HQ 129X, 10ML power described in Feb. '49, Q.S.T. Want movie equipment, 12 to 16" TV, recording equipment. J. B. Gardner 2229 Creston Ave., Bronx, N. Y.

FOR SALE—Precision 10-54P electronamic tube and circuit tester, perfect condition. Value, $134.40. Will sell for $90. Signal Radio, 2077 Coney Island Ave., Brooklyn 23, N. Y.

FOR SALE—Vol. 1, Howard Sams Photo Facts, excellent condition, $12; 4 No. 89 Nat. Union radio tubes at $1 each, original boxes; 2 No. 85 tubes, original boxes, $1. Clifford Lessig, Radio Service, 30 Fifth St., Frenchtown, N. J.

SELL OR SWAP—Meissner 9-1091 AM-FM 17 tube tuner, never used except to listen to. Need good 5" scope. Roland Bond, 2637 Westminister Ave., Dallas 5, Texas

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FOR SALE—New Astatic T-3 mike, $7; 3-way portable, like new, $10, Bud oscillator, $5; R'9er with 20M coil, $17; power supply for R'9er, $3.50; TV coil sets, $1.25 for R'9er. G. Samkofsky, 527 Bedford Ave., Brooklyn 11, N. Y.

SWAP—Over 50 radio and electrical books in good condition. Send for free list. I need test equipment, tubes, parts, movie projector, and other items. John Underhill, 116 Sheriff St., Apt. 306, New York 2, N. Y.

FOR SALE—Triplett signal generator, perfect condition, model 2432, with instruction book, $48. Tower Television Service, 338 Union St., Brooklyn 31, N. Y.

FOR SALE—EICO V.T.V.M. model 221, never used, $40. Will take signal generator as partial trade in. Inquiries welcomed. Albert Miller, 1075 Bryant Ave., New York 59, N. Y.

FOR SALE—5 tube superhet with cabinet, perfect working order, needs alignment and install. in cabinet. Also used Northland radio, needs alignment. Both $7.50. Bill's Radio Shop, 1521 Larrabee St., Chicago 10, Ill.

FOR SALE—ICA de luxe signatone, three output frequency audio oscillator and transmitter key monitor with built-in speaker. Complete with tube and telegraph key, $10. Otto Pollei, Jr., 118 No. Western Parkway, Louisville 12, Ky.

FOR SALE—CREI advanced radio course, completed in 1949, up-to-date with final examinations. $30 for the course. D. J. Cummings, 3420 Fenelon St., San Diego 6, Calif.

FOR SALE—Tungar bulbs, slightly used, and the following G.E.: No. 189049, 12X-825, 16X897 and Phanotron PT-874, at $1 each, postpaid. Victor Kozma, 3104 Wilkinson Ave., New York 61, N. Y.

SELL OR SWAP—2 small electric drill presses, precision built, powered by 1/32 h.p. motor, all new, $45 each or will consider good used Hallicrafter's commun. receiver. Faw Radio Service, 820 Rosedale Ave., Winston- Salem, N.C.

FOR SALE—522 receiver, model BC624-C, like new, converted with gears, $25; 522 transmitter, partially conv., $15. Write for list. R. Martick, 98 Forest Hills St., Jamaica Plain 30, Mass.

TRADE—Photo enlarger or Seeburg record changer for tube tester. Please give description in first letter. Sam Berenblum, Greenwich, Conn.

FOR SALE—BC 454, $6; 2 BC 455, $12; BC 788, $10; R-57 ARN-5A, $8; BC 733D, $8; BC 375E converted box 20 and 40m, $30; will consider trade. R. G. Silling, 808 Peddy St., Staunton, Va.

SWAP—Hallicrafter S-38, K & E polyphase slide rule. Want FM tuner, pistol, technical books. Mr. Jean Blanton, Box 158, Dahlgren, Va.

FOR SALE—Supreme signal generator, model 576, cost $65, also Supreme tube and set tester model 89 de luxe. Both for $65. Joseph Lishok, 220 South River Dr. N. W., Miami 36, Fla.

FOR SALE—RCA Rider chanalyst model 162C. Stancor model 752 6-volt power pack; Riders manuals, like new, 6-15; Howard Sams vols. 1-4. Write for prices. Carrs Television Center, 15-17 Kelley Sq., Worcester 4, Mass.

SELL OR TRADE—BC 348Q converted to 115 v. A.C. Will sell or trade for camera or what have you? M. J. Duniphin, Box 1091, Wewoka, Okla.

FOR SALE—Hallicrafter model T64 TV chassis with 12½" G.E. picture tube, good condition. Will ship railway express. First $135 takes it. C. W. Cassel, Box 203, Irwin, Pa.

SALE OR TRADE—Signal generator A-200-K, excellent condition, used once or twice, $20 cash or signal tracer in trade. J. Conroy, 2608 N. 11 St., Philadelphia, Pa.

FOR SALE—Philco auto radio model UN6-400 6-tube Superhet, excellent playing condiiton, $25. K. Kelmis, 153 W. 66 St., New York 23, N. Y.

WANTED—Supreme Service manuals in good condition. Min Takamoto, 420 Pearl St., Monterey, Calif.

SALE OR TRADE—Thordarson power transformer, type T-16 PO1 V.A. 610 Sec. 31-20 Sec. C.T. 2500 C.T. Pri 115 v. 60 cx, in perfect cond. Stanley Katz, 1050 Longfellow Ave., Bronx 59, N. Y.

FOR SALE—Riders manuals, 1-5 abridged, vol. 6-10, 13-15. Never used, any reasonable offer. All letters answered. Anthony Coppola, 915 McClellan St., Philadelphia 48, Pa.

WANTED—Phono oscillator with motor and arm. Will accept good home made unit. Will pay in advance. L. J. Long, 211 Ruby Pl., Apt. B, Gastonia, N. C.

WANTED—Riders manuals, Vol. 15 and 17; condenser tester. Tower Television Service, 338 Union St., Brooklyn 31, N.Y.

SELL OR SWAP—Perco FM tuner, 2 tube, AC-DC, in cabinet. Sell for $10 or trade for GI 4-pole, two-speed, recording-playback motor. R. J. Weinberger, 1134 Judson Ave., Evanston, Ill.

FOR SALE—Tube checker model 1185 portable carrying case, Triplett red dot life time meter, excellent condition at $17. C.O.D. Victor Kozma, 3104 Wilkinson Ave., New York N. Y.

WANTED—Complete set of Riders up-to-date. George B. Moon, Wasco, Ore.

SELL OR SWAP—Radios, radio parts, over 100 tubes. Write for list. Want types 43, 47, 36, 37, 38, 39 tubes. J. S. Chanin, P.O. Box 241, Benzonia, Mich.

FOR SALE—Sorenson model 1000 A. C. voltage regulator. Specifications: input voltage, 95-125; output v., adj. 110-120; load range, 0-1000VA; hermetically sealed components. Nathaniel Silver, 44 Main St., Stamford, Conn.

SALE OR TRADE—3" scope described in Feb. 1948 QST, cost $60 to build, sell for $40. Also McMurdo Silver 905 "Sparx", $30. Duane Beecher, 132 Doxey, Ogden, Utah

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TRADE—.25 cal. Italian carbine rifle, nickel plated partly, good condition. Will trade for test equipment. F. J. Muller, 77-33-66 Dr., Middle Village, L. I. N. Y.

WANTED—5-8 tube Superhet radio in good condition. Will sell Supreme 450 tube tester with condenser checker, $20. A-1 condition. E. Bruno, 29 Lincoln Ave., Poughkeepsie, N. Y.

WANT—G.E. ham news Nov-Dec. 1946 which has R'9er one tube preamplifier article. Also hear from anyone who converted BC 191/375 transmitter for 10-80 meters. David Jaffe, 947 44 St., Brooklyn 19, N. Y.

WANTED—Schematic on Superior model 620 ohmmeter. What offer for Supreme 385 automatic tester? H. D. Westbrooks, Box 281, Griffin, Ga.

SELL OR SWAP—Triplett 1200-C V.O.M. twin scales, like new, Triplett 1210 tube tester. Want condenser checker, tube checker. E. J. Flaga, 2832 N. Fairfield Ave., Chicago 18, Ill.

FOR SALE—E 200c signal generator, $50, plus C.O.D. and postage. About 100 tubes, 50% off. Few other parts are 50% list. Sylvania model 139 tube tester, $75. Wilbur Kespert, Youngsville, N. Y.

FOR SALE—Like new BC-654A (SCR-284) transreceiver complete with dynamotor, power converter, connecting cable, signal key, microphone. Also tubes. Best offer. F. R. Antalek, Glen Castle, Binghamton, N. Y.

SELL OR TRADE — Hickok 4956 AC-DC VOM. (4½" meter with 500 microamp movement, shunt, series ohmmeter circuits, 1000 ohms/v. sensitivity). Leads, excell. cond., $20 or trade. Geo. Steeg, 54 Baker Ave., Groton, Conn.

SELL OR TRADE—Tuning head or control box for ARN-7. Geared control for 4 bands. Complete with lights, meter, etc. Unused, unaltered. Charles Kunde, 4521 N. Kingshighway, St. Louis 15, Mo.

SELL OR SWAP—BC-348 with internal AC supply, $60, pair of new BC-222 Walkie Talkies, $50, Weston 663 v. ohmmeter, $20. Want signal gen., scope, ART-13, or what have you. Gau Radio Service, Box 285 Pierz, Minn.

SALE OR TRADE—RCA model AR-88 comm. receiver chassis. Please write. H. Latko, 1922 Dickens, Chicago, Ill.

FOR SALE— G. I. record changer, recorder and play-back; 12 w. amp., custom built, 2 inputs, 2 speed G. E. motor and turntable, 33 and 78 r.p.m.; Jensen auditorium speaker, 12 w. S. J. Feller, 3109 Br. 7 St., Brooklyn 24, N. Y.

SALE OR TRADE—New Weaver Cub scope with mounts. Ammunition, Winchester Leader or Remington Kleanbore .22 LR. 8 mm MC Mauser, Mauser 8 mm rifle. Want small camera, Vibroplex, or Blue Racer. S. E. Brink, Walton, N. Y.

SWAP—Set (8) Machine Shop Practice books, like new, by Amer. Tech. Society. Want radio test equipment or picture enlarger. Billy Jones, R.F.D. 2, Louisville, Tenn.

FOR SALE—V.T.V.M., signal generator, scope, tube and condenser checkers, volt, ohm, milliammeter, point tester, Books, parts slightly used. Cost over $500. Sell for $350. Nap Allair, 102 St. James Ave., Holyoke, Mass.

FOR SALE—Radio and appliance business with very good volume. $2,500 includes truck, stock, instruments, fixtures; established 14 years; good lease of $50 mo. Nate's Radio & Appliance Co., 114 E. 20 Ave., Denver, Colo.

FOR SALE—Heavy TV chassis 21 x 15", $3; armature tester, $2; heavy field coil, 15" speaker, $3; RCP multitester, $3. Edwin Androski, 18 Dover St., Paterson, N. J.

FOR SALE—Superior 600 tube and set tester one year old, Superior 650 signal generator, ATR 6 v. battery eliminator, model EL-1A. Best offer. James Hurst, 22 Jun St., Fall River, Mass.

FOR SALE—BC-459 and Heathkit power supply, $25; BC-458 and BC-457, both converted to ham bands, $5 each; Stancor 110CM, 100 w. phone transmitter, $50. Ex. cond. Louis Owen, 5 E. Burgess St., Mt. Vernon, Ohio

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FOR SALE—Jackson model 640 test oscillator, 100 kc to 32 M. C., $20 postpaid in U. S. P. H. Case, Box 295, Ansley, Neb.

FOR SALE—BC412B scope with tubes, link mobile phone transmitter, RCA-156 tube tester, RCP-663A vacuum tube voltohm capacity meter with leads and manual. All good condition. W. J. Butsh, Standish, Mich.

FOR SALE—Presto K-8 recorder, RCA cube Lo & Hi freq. horn speaker, Hammond organ D-20 amplifier-speaker unit, all in good condition. Neal Page, 7636 Circle Hill, Oakland 5, Calif.

FOR SALE — Webster automatic record changer No. 56, $20; Superior 450 tube tester, used, $30; Radio City signal generator, model 705, used, $40. E. A. Anderson, R.F.D. 1, Garfield, Wash.

FOR SALE—N.R.I. signal generator, model 88, N.R.I. signal tracer, model 33, both used a little; Heathkit V.T.V.M. assembled, calibrated; Heathkit condenser checker partly assembled. Make offer. H. N. Greene, 23 N.W. 9 St., Oswego, N. Y.

FOR SALE—Meissner phone recorder,model 9-1065. Best offer. Used as demonstrator, has radio built in, portable case. Will consider trade for 5" scope. Bristol Radio and Appliance Service, 74 Adams St., Salamanca, N. Y.

TRADE—For sound movie projector, a Supreme 589A tube tester, perfect condition; 7 tube Goldentone table model radio, needs some servicing; speakers, tubes, etc. U. J. Hebert, Belle Rose, La.

FOR SALE—Amertran plate transformer, 3200-0-3200 volts center tapped at 700 MA, $35, F.O.B. Springfield. Donald Myers, RR 5, Box 137, Springfield, Ill.

SELL OR TRADE—Tubes 316A, 3C24, 955, 954 and receiving types; receiving/transmitting equip. used in class 2 Band Station. Want sensitive and A.C. relays, selenium rectifiers, etc. O. C. Vidden, Fertile, Minn.

FOR SALE—Hickok model 209 V.T.V.M. with high freq. probe for TV, used three months, guaranteed good cond., $80. Plastic cover. Jim Pennington, Box 244 Industry, Ill.

WANTED—Will pay price quoted within reasonable range for answers on National Radio School Home study course, answers 36 to end, incl. tests, etc. W. G. Bonnt, 1002 St. Marys Blvd., Jefferson City, Mo.

FOR SALE—Hallicrafter S40 receiver now in use. Want BC348 or BC342 receiver. G. V. Metzger, 15 Clark St., Brooklyn 2, N. Y.

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